



**UNITED STATES**  
**NUCLEAR REGULATORY COMMISSION**  
REGION II  
245 PEACHTREE CENTER AVENUE N.E., SUITE 1200  
ATLANTA, GEORGIA 30303-1200

April 27, 2022

Mr. Brian Hunt  
Plant Manager  
Honeywell Metropolis Works  
P.O. Box 430  
Metropolis, IL 62960

SUBJECT: HONEYWELL METROPOLIS WORKS – U.S. NUCLEAR REGULATORY  
COMMISSION INTEGRATED INSPECTION REPORT NUMBER 40-3392/2022-001

Dear Mr. Hunt:

This letter refers to the inspections conducted from January 1 through March 31, 2022, for the Honeywell Metropolis Works facility in Metropolis, IL. During that period, the U.S. Nuclear Regulatory Commission (NRC) did not conduct inspection activities on-site, however, in-office inspection of License Condition (LC) 35A were conducted.

The enclosed report presents the results of the inspections, which were conducted through a combination of document reviews and interviews. The inspectors reviewed activities as they relate to public health and safety, the common defense and security, and compliance with the Commission's rules and regulations, as well as the conditions of your license. The inspections covered the areas of Safety Operations. The findings were discussed with members of your staff at an exit meeting held on April 15, 2022.

Based on the results of these modified inspections, no violations of more than minor significance were identified, and Honeywell met the requirements of LC 35A.

In accordance with Title 10 of the *Code of Federal Regulations*, Section 2.390 of the NRC's "Rules of Practice and Procedure," a copy of this letter and enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy or proprietary, information so that it can be made available to the Public without redaction.

B. Hunt

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Should you have any questions concerning these inspections, please contact Tom Vukovsky, Senior Project Inspector of my staff at 404-997-4622.

Sincerely,



Signed by Michel, Eric  
on 04/27/22

Eric C. Michel, Chief  
Projects Branch 2  
Division of Fuel Facility Inspection

Docket No. 40-3392  
License No. SUB-526

Enclosure:  
NRC Inspection Report 40-3392/2022-001  
w/Supplemental Information

cc: w/enclosure via LISTSERV

SUBJECT: HONEYWELL METROPOLIS WORKS – NUCLEAR REGULATORY  
COMMISSION INTEGRATED INSPECTION REPORT 40-3392/2022-001  
DATED APRIL 27, 2022

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OFFICE	RII:DFFI/PB2	RII:DFFI/PB2	RII:DFFI/PB2		
NAME	T. Vukovsky	N. Peterka	E. Michel		
DATE	04/27/2022	04/27/2022	04/27/2022		

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**U. S. NUCLEAR REGULATORY COMMISSION  
REGION II  
INSPECTION REPORT**

Docket No.: 40-3392

License No.: SUB-526

Report No.: 40-3392/2022-001

Enterprise Identifier: I-2022-001-0088

Licensee: Honeywell International, Inc.

Facility: Metropolis Works

Location: Metropolis, IL 62960

Dates: January 1 through March 31, 2022

Inspectors: T. Vukovsky, Senior Fuel Facility Inspector (Section A.1)  
N. Peterka, Fuel Facility Inspector (Sections A.1)

Approved by: Eric C. Michel, Chief  
Projects Branch 2  
Division of Fuel Facility Inspection

Enclosure

## **EXECUTIVE SUMMARY**

Honeywell International, Inc.  
Honeywell Metropolis Works  
Nuclear Regulatory Commission Integrated Inspection Report 40-3392/2022-001  
January 1 through March 31, 2022

The U.S. Nuclear Regulatory Commission (NRC) regional inspectors conducted in-office inspections in the area of Safety Operations. The inspectors performed an examination of License Condition 35, that were accomplished by record reviews, interviews and discussions with licensee personnel, and a review of facility records. No violations of more than minor significance were identified during the inspection.

### **Safety Operations**

- In the area of Operational Safety, no violations of more than minor significance were identified, and Honeywell met the requirements of LC 35A. (Paragraph A.1)

#### **Attachment:**

Key Points of Contact

List of Items Opened, Closed, and Discussed

Inspection Procedures Used

Documents Reviewed

## **Summary of Plant Status**

The Honeywell Metropolis Works (MTW) is a uranium conversion facility located near Metropolis, IL. The licensee is authorized to possess 150 million pounds of natural uranium ore and to convert the uranium ore into uranium hexafluoride (UF<sub>6</sub>). During this inspection period, all uranium conversion processing remained shut down, processing equipment emptied, referred to as ready-idle status. The only significant NRC licensed uranium operations being conducted included the receipt, sampling, storage, and shipment of uranium ore, and radiological support staff operations.

### **A. Safety Operations**

#### **1. Operational Safety (Inspection Procedure 88020)**

##### **a. Inspection Scope**

The inspectors evaluated Honeywell's License Condition (LC) 35 which requires Honeywell (MTW) to perform specific accident analysis of nine items listed in LC 35(A) prior to the re-start of UF<sub>6</sub> production. The inspectors evaluated each of the nine items listed in the LC and are detailed below:

#### **1. LC 35A Item 1), Evaluation of Accident Sequence DI-7: Vaporization of UF<sub>6</sub> Cylinders**

The inspectors reviewed Honeywell's evaluation of Accident Sequence DI-7 as described in MTW-CALC-DIS-0214, "Evaluation of Accident Sequence DI-7: Vaporization of UF<sub>6</sub> Cylinders." The unmitigated consequence of this accident sequence resulted in a likelihood index of -2 which would be "not unlikely." Therefore, Honeywell credited two PFAPs to reduce the calculated index.

- PFAP-82 provides a remote-controlled drive motor on the product cylinder which can be immediately closed by operator action to prevent the flow of UF<sub>6</sub> from the cylinder.
- PFAP-83 specifies pigtail inspection, installation of new gaskets, and pigtail/fitting leak testing prior to use.

The inspectors determined that the use of these PFAPs, in conjunction with the initiating event frequency, results in an overall likelihood index of -6, which results in a "highly unlikely" sequence which is acceptable for all levels of consequence severity (low, intermediate, and high).

#### **2. LC 35A Item 2), Evaluation of Accident Sequences CM-1 and CM-2: On-site UF<sub>6</sub> Cylinder Transport**

The inspectors reviewed Honeywell's evaluation of Accident Sequences CM-1 and MC-2 as described in MTW-CALC-UF6-0004, "Evaluation of Accident Sequences CM-1 and CM-2: On-site UF<sub>6</sub> Cylinder Transport." This calculation determines the risk associated with a postulated accident during cylinder transport from the Feeds Material Building (FMB) to the storage yard. The postulated drop of a 48-inch cylinder during transport of the cylinder from the FMB to the cooling area or the drop of a solidified cylinder in the storage yard will not result in a cylinder failure. No cylinder failure is expected because the IAEA drop tests require that the cylinder survive a 9-meter drop test onto a flat unyielding surface without releasing significant radioactivity. The inspectors verified that the risk calculation and methodology used by the licensee is acceptable for both assumed release scenarios and no new PFAPS are required.

### **3. Licensing Condition 35.A, Items 3), 4), and 5)**

Section 35.A of the Materials License requires that Honeywell shall perform specific accident analyses prior to the re-start of UF6 production at the Honeywell Metropolis Works (MTW). These analyses include the analysis of past and potential accidents, and accidents with the potential to reoccur, and shall include the below specific accidents and hazards:

- 3) a leak of UF6 in the Feed Materials Building (FMB) that occurred on October 26, 2014 during the routine sublimation and draining of a cold trap.
- 4) the release of UF6 during a cold trap valve decontamination that occurred in February 2014.
- 5) the release of UF6 from the low boiler condensers that occurred in August 2015.

Each of the referenced accidental releases involve the unplanned release of small amounts of UF6. These separate events will be discussed, and a bounding analysis will be presented.

#### **LC35.A, Item 3), a leak of UF6 in the FMB that occurred on October 26, 2014, during the routine sublimation and draining of a cold trap:**

This item is discussed in MTW Investigation Report ITCA# IR-14-2620, dated 2/10/2015, "NRC Confirmatory Action Letter and UF6 Release at 3B Primary Cold Trap." On 10/26/2014 at 6:32 pm, Honeywell MTW experienced a UF6 release from the 3B Primary Cold Trap (PCT). The release occurred as the cold trap was being heated in order to transfer UF6 liquid to the still feed tanks in Distillation. The cause of the leak was determined to be a mechanical failure in the seal weld at the cold trap shell and tube sheet flange. There were no injuries, and the reported release amount was calculated to be 5.8 lbs of UF6, which converts to about 1.3 lbs of HF.

The NRC inspection report of this incident was documented in, "HONEYWELL METROPOLIS WORKS – NUCLEAR REGULATORY COMMISSION INTEGRATED INSPECTION REPORT 40-3392/2014-005," dated January 30, 2015. This inspection report stated that:

The inspectors reviewed the licensee's calculations on the amount of UF6 and HF released and its subsequent plume estimate. The inspectors concluded that the licensee's estimate of approximately 6 pounds of UF6, which would result in less than two pounds of HF released, was reasonable. Additionally, the NRC performed its own independent plume model based on the estimated amount released which confirmed the licensee's results that a significant concentration of HF did not reach the fence line.

NRC Letter EA-14-183, dated November 25, 2014, entitled "COMPLETION OF CONFIRMATORY ACTION LETTER- HONEYWELL METROPOLIS WORKS," concluded that Honeywell MTW has satisfactorily completed all commitments as stated in the November 7, 2014, Confirmatory Action Letter (CAL) (ML14311A670).

#### **LC35.A, Item 4), the release of UF6 during a cold trap valve decontamination that occurred in February 2014:**

This item is discussed in MTW Incident Report IR-14-0452, dated 2/26/2014, "Contractor cleaning UF6 valve with hot steam caused possible release." During this event, a 2-inch valve (PP-1 Valve) removed from 2A PCT was being cleaned while in a 55-gallon drum of water on the Decon pad on the 3rd floor of the FMB by contractor personnel with hot steam, and it possibly generated a UF6 release on FMB 3rd and 4th floor. The valve was hoisted from the water while steaming. The distillation operator noticed what looked like UF6 possibly mixed with

the steam coming from the Decon pad. The 3rd and 4th floor lights were already on due to planned work in the Green Salt areas. Both employees steaming the valve were in full chemical suits.

Five contractors working on the 4th floor reported to the dispensary complaining of possible exposure and throat irritation. One was treated with a nebulizer, and all were instructed to report to the plant if they experienced any trouble through the night.

The event released a small, but unquantified, amount of UF<sub>6</sub> contained within the valve body. Other than mild onsite consequences, no other consequences were reported.

**LC35.A, Item 5), the release of UF<sub>6</sub> from the low boiler condensers that occurred in August 2015:**

The NRC Inspection Report of this incident is documented in "HONEYWELL METROPOLIS WORKS – NUCLEAR REGULATORY COMMISSION INSPECTION REPORT 40-3392/2015-008 AND NOTICE OF VIOLATION, EA-15-217," dated November 16, 2015.

The inspection report stated that the release was a result of the No. 4 Low Boiler Condenser (LBC) being left unattended after it was opened on July 31, 2015, and hazards were not properly controlled. Specifically, line breaking on the No. 4 LBC was followed by a period of down time, and the blind flanges used to cap the breaks in the system were not properly secured. This provided a release pathway for uranium hexafluoride and contributed to the event on August 1, 2015.

The Honeywell MTW's response to the NRC Inspection Report 40-3392/2015-008 and Notice of Violation dated November 16, 2015, is provided by letter dated December 11, 2015 (ML15348A384). The NRC staff determined, in the inspection report, that had a worker been in the immediate vicinity of the release point at the outset of the release and not wearing respiratory protection, a significant intake of uranium hexafluoride could have occurred if the worker did not evacuate in a timely manner. Enclosure 2 of the inspection report provided the basis for the NRC conclusion that a worker would not have received a significant exposure had the worker been present and evacuated in a timely manner.

The staff evaluation was based on the following:

- 1) Based on the assumptions in the licensee's Integrated Safety Analysis (ISA) Summary and training provided to workers; NRC staff assumed that there was a high probability that any workers that had been in close vicinity of the release would have evacuated the area of concern within 10 seconds.
- 2) The average release rate over the 86-minute release was 63.3 grams of uranium per minute (12 lbs of uranium released, total).
- 3) Based on the pressure spike in the vacuum line, staff estimated that the release rate over the first 10 seconds was 168 grams of uranium per minute.
- 4) Staff assumed that the breathing rate of a worker was 1.2 cubic meters per hour, as defined in 10 CFR 20.1003.
- 5) Staff also assumed that all the uranium released in the first 10 seconds was contained in a 10 cubic meter sphere as indicated in video footage of the release.
- 6) For the uranium consequence calculation, staff also assumed that all uranium remained suspended rather than reacting with the moisture in the air.



Volume of spherical plume at 10 sec (m <sup>3</sup> )	10
Release rate (g/min)	168.0
Grams of U in sphere at 10 sec (g)	28.0
Concentration in sphere at 10 sec (g U/m <sup>3</sup> )	2.80
Average concentration in sphere over 10 sec (g U/m <sup>3</sup> )	1.40
Average normal inhalation rate (m <sup>3</sup> /min)	0.02
U-intake in 10 sec (g)	<b>0.0047</b>

NRC staff determined from the simplified intake calculation and the conservatisms built into the values that the 4.7 mg of uranium estimated uptake was significantly below the threshold value of 10 mg of uranium for an intermediate consequence as defined in the Honeywell ISA Summary (Revision 9).

The inspectors reviewed Honeywell's analysis of the release as detailed in calculation MTW-CALC-UF6-0003, "Evaluation of the 12-pound UF6 Release at the Metropolis Works Facility." MTW's analysis concluded with the results that after a five second exposure, the worker has inhaled approximately 1.17 mg of uranium, and after a ten second exposure, the worker has inhaled approximately 4.30 mg of uranium. These values are well below the 10-mg intake limit for an intermediate consequence event. Therefore, the UF6 release which occurred at Honeywell resulted in a low consequence event to workers. This result substantially confirms the NRC Staff result.

The second inhalation hazard associated with a uranium hexafluoride release is the hydrogen fluoride (HF) intake. For the HF calculation, the NRC staff compared calculated concentrations to the HF concentration limits as defined in the licensee's ISA Summary. The ISA Summary limits are based on Acute Exposure Guideline Levels (AEGLs) and experimental data. An intermediate consequence was defined as a worker being exposed to a concentration of 137 milligrams per cubic meter for one minute. NRC Staff calculated the average concentration of HF in a 10 cubic meter sphere over the first 10 seconds of the release to be 280 milligrams per cubic meter. Although exposure to 137 milligrams per cubic meter for one minute cannot be directly compared to exposure to 280 milligrams per cubic meter for 10 seconds, concentrations would need to be exponentially higher than 280 milligrams per cubic meter at shorter times to result in the same consequence. Therefore, staff qualitatively determined that workers in the area of the release would not have received a significant intake of HF as long as they evacuated within 10 seconds of detection.

The inspectors reviewed MTW's evaluation of the self-rescue failure probability associated with HF releases (the action failure probability for a UF6 release would be the same). The human error probability associated with the self-rescue action is based on the assessment of various performance shaping factors (PSFs). The first of the action PSFs is the available time. For an intermediate event, the limit is 137 milligrams per cubic meter for one minute. From the NRC evaluation, the evacuation time (10 seconds) is less than a sixth of the limiting exposure time for an intermediate event. The second PSF, stress, is normal because of the frequency of green salt spills (dust outs) at MTW would reduce the stress level because this is a known event. The third PSF, complexity, is judged to be nominal because the only worker action required is the evacuation of the area. The fourth PSF, experience/training, is evaluated as high because of the initial and ongoing training programs at MTW. The fifth PSF, procedures, is judged to be

nominal because of the procedural direction to evacuate the area. The sixth PSF, ergonomics, is judged to be good because there are no human-machine interactions involved in evacuating the area. The seventh PSF, fitness for duty, is judged to be nominal because of the existing MTW fitness for duty program. The final PSF, work processes, is judged to be good because of the performance of all work in accordance with approved procedures. Based on these PSFs, the action failure probability is  $1.25 \times 10^{-5}$ . This would be characterized as unlikely using the NUREG-1520 criteria.

Based on the above, the event described in Item 5) is a low consequence event with an unlikely self-rescue failure probability. Because this is a low consequence event (Consequence Category 1) with an unlikely likelihood category (Likelihood Category 2) the risk is acceptable based on the risk matrix given in Table 4-8 of the ISA Summary. Therefore, no PFAPs are required for this event.

Because the UF6 releases given in Items 3) and 4) are bounded by the UF6 release given in Item 5), Items 3) and 4) are also low consequence events with an unlikely self-rescue probability. The inspectors verified that the risk calculation and methodology used by the licensee is acceptable and no PFAPs are required for Items 3), 4), or 5).

#### **6. LC35.A, Item 6), evaluation of the hazards, consequences, and safety controls listed in Section 6.3 of the ISA Summary**

The inspectors reviewed Honeywell's evaluation of hazards, consequences, and safety controls as listed in Section 6.3 of the ISA Summary specifically regarding the potential release of UF6 or HF. The inspectors determined that Honeywell analyzed the potential hazards and consequences and where necessary applied PFAPs (safety controls) to mitigate the applicable accident sequences to a "highly unlikely" probability which is acceptable for all levels of consequence severity (low, intermediate, and high).

#### **7. LC35.A, Item 7), evaluation for the potential release of NH4 or UF6 following a loss of off-site power:**

The inspectors reviewed Honeywell's analysis for the potential release of ammonia (NH4) and uranium hexafluoride (UF6) following a loss of off-site power. This is documented in "Response to Request for Additional Information Honeywell Metropolis Works Safety Basis and Corrective Action Plan Dated November 30, 2012, for Docket: 40-3392" in the form of a process hazard analysis (PHA).

The NRC reviewed and verified the conclusions reached in the PHA that a loss of power to the site had a risk factor of three or less which is considered acceptable risk in the ISA and does not require PFAPs to mitigate the potential consequences.

#### **8. LC35.A, Item 8), evaluation for the potential of significant buildup of combustible materials near buildings:**

The license condition was a result of a Notice of Violation given in 2014 (40-3392/2014-002) for a large amount of combustible wood pallets stored near a process building beyond the amount allowed by site procedures. The inspectors reviewed Honeywell's analysis for the potential of significant buildup of combustible materials around certain process buildings which could result in a fire large enough to affect the structural integrity of the buildings. In this analysis Honeywell performed a combustible loading calculation using NUREG-1805, "Fire Dynamics Tools."

The evaluation was performed for three process buildings: Building 20 (Potassium Hydroxide), 23 (Ore Sampling), and 29 (Feed Materials Building). It was determined that the only building feasible to store enough combustible material (wooden pallets) next to it was the Ore Sampling Building. The inspectors reviewed and verified the conclusions reached in the analysis using NUREG 1805 that for the two plausible scenarios near the Ore Sampling building, there would not be a structural failure due to a pallet fire and a significant buildup of combustible materials is not a concern.

**9. LC35.A, Item 9), evaluation of processes involving potassium hydroxide (KOH), sodium hydroxide (NaOH), magnesium hydroxide (MgOH) and sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) when mixed with licensed material:**

The inspectors reviewed Honeywell's analysis of processes involving KOH, NaOH, MgOH, and sulfuric acid when mixed with licensed material and the potential consequences of exposure. These chemicals by themselves are not regulated by the NRC, however once they become comingled with licensed material (uranium) an analysis must be performed to ensure the potential exposure to these chemicals does not result in an unacceptable exposure to the worker.

Honeywell performed a process hazard analysis of the above chemicals and documented the results in MTW-RPT-GEN-0010, "Evaluation of Consequences Following an Accidental Release of H<sub>2</sub>SO<sub>4</sub>, NaOH, or KOH" and MTW-CALC-GEN-0034, "Evaluation of KOH, H<sub>2</sub>SO<sub>4</sub>, NaOH, and MgOH when mixed with licensed material." The inspectors reviewed and verified the conclusions reached in the analysis that the consequences to a worker for the potential exposure to the above chemicals is low and does not require safety controls (PFAPs).

**b. Conclusion**

The accident analyses of the nine items listed in License Condition 35A adhered to the licensee's configuration management program. The NRC's review of the above license conditions confirms Honeywell's compliance with License Condition 35A.

**B. Exit Meetings**

The inspection scope and results were presented to Mr. Sean Patterson, Regulatory Affairs Manager, at an exit meeting conducted on April 15, 2022. Proprietary information was discussed, but not included in this report.

**1. KEY POINTS OF CONTACT**

<u>Name</u>	<u>Title</u>
S. Patterson	Regulatory Affairs and ESH Manager
R. Sanders	Senior Quality Engineer

**2. LIST OF ITEMS OPENED, CLOSED AND DISCUSSED**

None

**3. INSPECTION PROCEDURES USED**

88020	Operational Safety
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**4. DOCUMENTS REVIEWED**

Records:

Evaluation of the hazards, consequences, and safety controls described in Section 6.3 of the ISA Summary as required by SUB-526 License Condition 35 #6, dated 01/10/2022  
MTW-CALC-DIS-0214, Evaluation of Accident Sequence DI-7: Vaporization of UF6  
Cylinders, Rev.0

MTW-CALC-FPP-0006, Fire Resistance for BD-20, BD-23, and BD-29, Rev. 0

MTW-CALC-GEN-0034, Evaluation of KOH, H<sub>2</sub>SO<sub>4</sub>, NaOH, and MgOH when mixed with  
licensed material, Rev. 0

MTW-CALC-UF6-0004, Evaluation of Accident Sequences CM-1 and CM-2: On-site UF6  
Cylinder Transport, Rev. 0

MTW-CALC-UF6-0003, Evaluation of the 12-pound UF6 Release at the Metropolis Works  
Facility, Rev. 0

MTW-PR-GEN-0008, Project Report for Honeywell MTW Self Rescue for Exposure to UF6,  
Rev. 0

MTW-CALC-UF6-0003, Evaluation of the 12-pound UF6 Release at the Metropolis Works  
Facility, Rev.0

MTW-RPT-GEN-0010, Project Report for Metropolis Works Wet Process Hazards Analysis,  
Rev. 0